Enhanced Water Quality Monitoring and Modeling Program for the A.R.M. Loxahatchee National Wildlife Refuge Quarterly Update Report – December 2011

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Overview

This update is a summary of activities since the previous status report of September 2011 on the implementation of the Refuge's Enhanced Water Quality Monitoring and Modeling Program. A project overview, and other detailed information about the program can be found at: http://sofia.usgs.gov/lox_monitor_model/. The primary objective of this overall program (Brandt et al. 2004) focuses on providing information for use in ecological management of the Refuge (e.g., USFWS 2007a, b; USFWS 2009; USFWS 2010a, b).

The Refuge's monitoring component of this program also addresses one of the Consent Decree Principals recommendations (17 December 2003):

> ***B. Enhancing Monitoring of the Refuge***
> *Design and implement an enhanced monitoring program to improve spatial and temporal understanding of factors related to phosphorus dynamics.*

Information Availability

Through collaboration with USGS, information from the Refuge's Enhanced Water Quality Monitoring and Modeling Program has been made available on the USGS' SOFIA web site at: http://sofia.usgs.gov/lox_monitor_model/.

Final data for monthly samples through May 2006 are publicly posted on DBHYDRO by the SFWMD at http://my.sfwmd.gov/dbhydroplsql/show_dbkey_info.main_page. Data for June 2006-December 2011 are posted on the Technical Oversight Committee's web site at http://www.sfwmd.gov/toc/. This report includes information from samples collected through December 2011.

Water Quality Data Analyses Update

Primary efforts for this quarter involved exploring mechanisms to continue translating information from the program to aid in Refuge management decisions, and working on the program's Annual Report.

Monitoring Update (October – December 2011)

Sampling of the enhanced water quality monitoring network (**Figure 1**) occurred at 36 stations in October and 37 stations in November and December 2011 (**Table 1**).

Total phosphorus data available to date for January through December 2011 are presented in **Table 1**. Maps of stations where samples were collected for the months from October through December 2011 are presented in **Figures 2-4**.

Conductivity sonde deployment information for January through December 2011 is presented in **Table 2**.

Next Steps

The next steps for this program include additional efforts on the Annual Report, and additional model development and application.

References

Brandt, L.A., Harwell, M., Waldon, M. (2004) Work Plan: Water Quality Monitoring and Modeling for the A.R.M. Loxahatchee National Wildlife Refuge: 2004-2006. Prepared for the A.R.M. Loxahatchee National Wildlife Refuge. April, 2004. 33 pp.

USFWS. (2007a) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Monitoring and Modeling Program – 2nd Annual Report – February 2007. LOXA06-008, U.S. Fish and Wildlife Service, Boynton Beach, FL. 183 pp.

USFWS. (2007b) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 3rd Annual Report – October 2007. LOXA07-005, U.S. Fish and Wildlife Service, Boynton Beach, FL. 116 pp.

USFWS. (2009) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 4th Annual Report – July 2009. LOXA09-007, U.S. Fish and Wildlife Service, Boynton Beach, FL. 106 pp.

USFWS. (2010a) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 5th Annual Report – September 2010. LOXA08-007, U.S. Fish and Wildlife Service, Boynton Beach, FL. 43 pp.

USFWS. (2010b) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 6th Annual Report – October 2010. LOXA09-011, U.S. Fish and Wildlife Service, Boynton Beach, FL. 42 pp.

Table 1. Total phosphorus data (ppb) available for January 2011 – December 2011 from the Enhanced Water Quality Monitoring Program for: (a) marsh, and (b) canal stations for the A.R.M. Loxahatchee National Wildlife Refuge. Graphical representation of station locations are shown in Figure 1.

a) Marsh stations

Marsh Station	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11
LOXA101	12	-	-	-	-	-	-	-	39	18	15	13
LOXA102	-	-	-	-	-	-	-	-	-	14	13	8
LOXA103	-	-	-	-	-	-	-	-	-	9	12	11
LOXA105	-	-	-	-	-	-	-	-	26	32	20	17
LOXA106	-	-	-	-	-	-	-	-	-	19	14	12
LOXA107	-	-	-	-	-	-	-	-	-	-	8	7
LOXA108	-	-	-	-	-	-	-	-	-	7	6	5
LOXA109	7	8	-	-	-	-	-	-	24	17	13	9
LOXA110	-	-	-	-	-	-	-	-	13	7	6	6
LOXA111	41	10	51	-	-	-	-	-	8	8	9	8
LOXA112	-	-	-	-	-	-	-	-	11	11	12	10
LOXA113	4	-	-	-	-	-	-	-	8	7	7	8
LOXA114	5	-	-	-	-	-	-	-	7	8	7	8
LOXA117	12	14	-	-	-	-	-	-	29	27	20	17
LOXA118	7	9	-	-	-	-	-	-	16	18	13	11
LOXA119	14	17	-	-	-	-	-	-	10	10	9	7
LOXA120	6	10	13	29	-	-	-	-	10	11	8	6
LOXA122	13	13	-	-	-	-	-	-	20	20	17	13
LOXA124	7	15	-	-	-	-	-	-	13	18	8	8
LOXA126	5	7	-	-	-	-	-	-	15	10	23	9
LOXA127	-	9	-	-	-	-	-	-	5	8	4	6
LOXA128	-	-	-	-	-	-	-	-	-	8	7	6
LOXA130	5	13	21	-	-	-	27	-	28	15	11	13
LOXA131	5	9	-	-	-	-	15	-	8	7	7	8
LOXA133	-	-	-	-	-	-	-	-	42	30	23	24
LOXA134	5	12	-	-	-	-	-	-	16	13	10	11
LOXA136	11	17	-	-	-	-	-	-	57	32	18	16
LOXA137	11	14	-	-	-	-	-	-	27	17	18	14
LOXA138	-	-	-	-	-	-	-	-	14	5	11	8
LOXA139	-	-	-	-	-	-	-	-	-	5	6	5
LOXA140	-	-	-	-	-	-	-	-	28	13	14	11
LOXA141	11	61	12	21	-	-	-	-	23	14	20	19
MAX	41	61	51	29	-	-	27	-	57	32	23	24
MIN	4	7	12	21	-	-	15	-	5	5	4	5

Table 1 cont.

b) Canal stations

Canal Station	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11
LOXA104	21	29	32	33	40	32	30	34	26	22	25	22
LOXA115	20	22	23	33	32	45	31	36	25	29	21	19
LOXA129	30	41	63	70	71	79	45	48	21	18	17	28
LOXA132	39	43	59	66	74	79	39	36	20	16	19	16
LOXA135	32	33	46	53	62	77	39	26	16	17	24	15
MAX	39	43	63	70	74	79	45	48	26	29	25	28
MIN	20	22	23	33	32	32	30	26	16	16	17	15

Table 2. January 2011– December 2011 conductivity sonde deployment information, separated by transect, for the A.R.M. Loxahatchee National Wildlife Refuge. X = data collected from sonde deployment during that month. Graphical representation of station locations are shown in Figure 1.

	2011											
Site ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
LOXA104	X	X	X	X	X	X	X	X	X	X	X	
LOXA105	X		X		X		X	X	X	X		X
LOXA106	X		X		X		X	X	X	X		X
LOXA107	X		X		X		X	X	X			X
LOXA108	X		X		X		X	X	X		X	X
LOXA111		X		X		X	X		X		X	
LOXA112		X		X		X	X		X		X	
LOXA113		X		X		X	X		X		X	
LOXA114		X		X		X	X		X		X	
LOXA115	X	X	X		X	X	X	X	X	X	X	
LOXA116		X	X					X		X	X	
LOXA117		X	X					X		X	X	
LOXA118		X	X					X	X	X		
LOXA119		X	X					X		X	X	
LOXA120		X	X					X		X	X	
LOXA126		X		X		X	X		X		X	
LOXA127		X		X		X	X		X		X	
LOXA128		X		X		X	X		X		X	
LOXA129	X	X	X	X	X	X	X	X	X	X	X	
LOXA130	X		X		X		X	X	X			X
LOXA131	X		X		X		X	X	X			X
LOXA132	X	X	X	X	X	X	X	X	X	X	X	
LOXA133	X		X		X		X	X	X			X
LOXA135	X	X	X	X	X	X	X	X	X	X	X	
LOXA136	X		X		X			X	X			X
LOXA137	X		X		X		X	X	X			X
LOXA138	X		X		X		X	X	X			X
LOXA139	X		X		X		X	X	X			X
LOXA142		X		X	X			X	X	X		X
LOXA143		X	X					X	X	X		
LOXA144		X	X					X	X	X		
LOXA145		X	X					X	X	X		
LOXA146		X	X					X	X	X		
LOXA147		X	X		X		X		X			X
LOXA148		X	X		X		X		X		X	
LOXA149		X	X		X		X		X		X	
LOXA150		X	X		X		X		X		X	
LOXA151	X	X	X	X	X	X	X	X	X	X	X	
LOXA152	X	X	X	X	X	X	X	X	X	X	X	
LOXA153	X	X	X	X	X	X	X	X	X	X	X	
I-8C	X	X	X	X	X	X	X	X	X	X	X	X
LOX04	X		X		X		X	X				X
LOX06		X		X		X	X		X		X	
LOX07		X		X		X	X		X		X	
LOX08		X		X		X	X		X		X	
LOX09		X		X		X	X		X		X	
LOX10		X		X		X	X		X		X	
LOX15		X	X		X		X		X		X	X

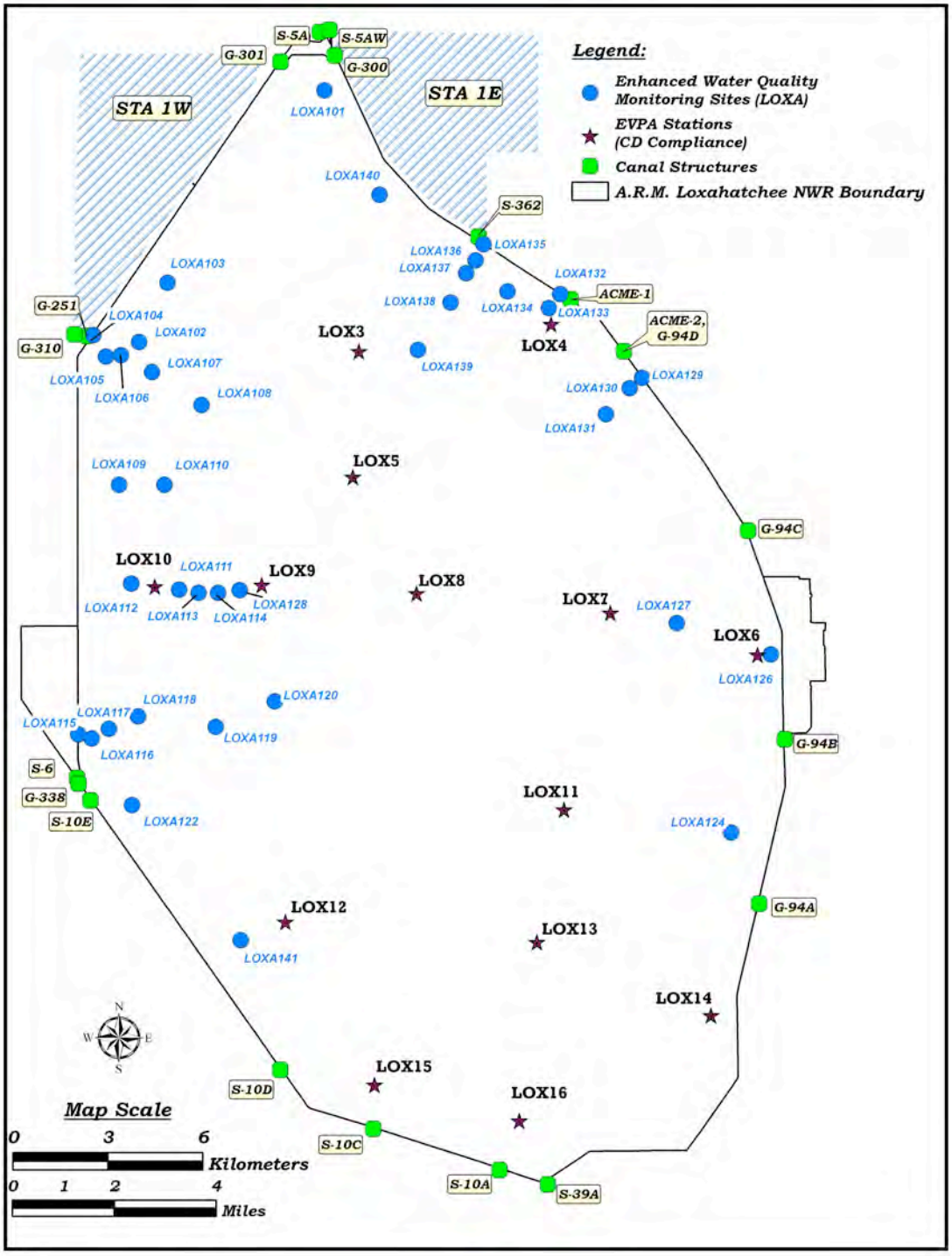

Figure 1. Location of Enhanced Water Quality Monitoring network stations (LOXA###), in relation to Consent Decree compliance stations (LOX##), for the A.R.M. Loxahatchee National Wildlife Refuge.

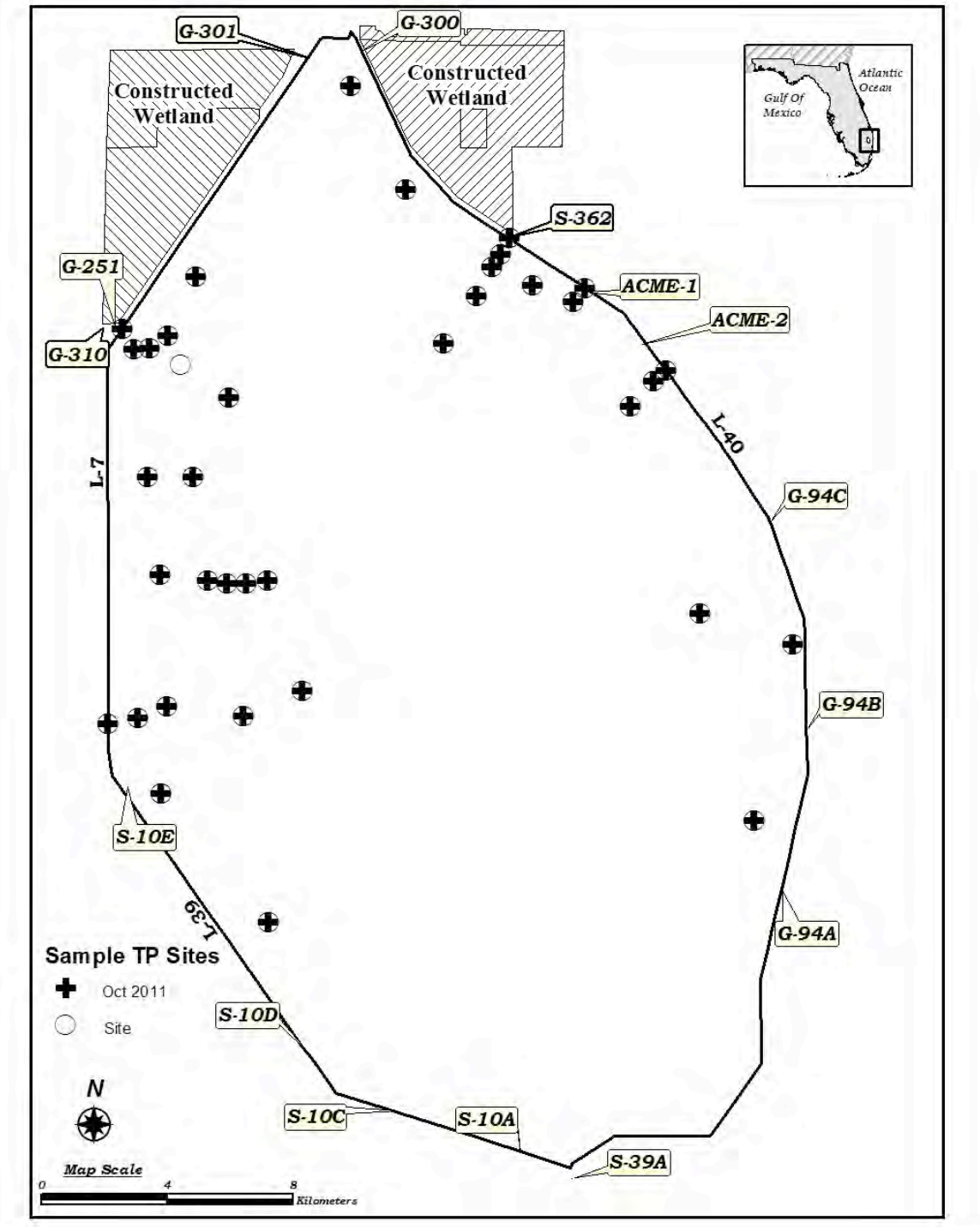

Figure 2. October 2011 map of total phosphorus sample collections from the Enhanced Water Quality Monitoring and the EVPA stations in the A.R.M. Loxahatchee National Wildlife Refuge. A primary reason that a station is not sampled is that it has less than 10 cm of clear water column representative of that area.

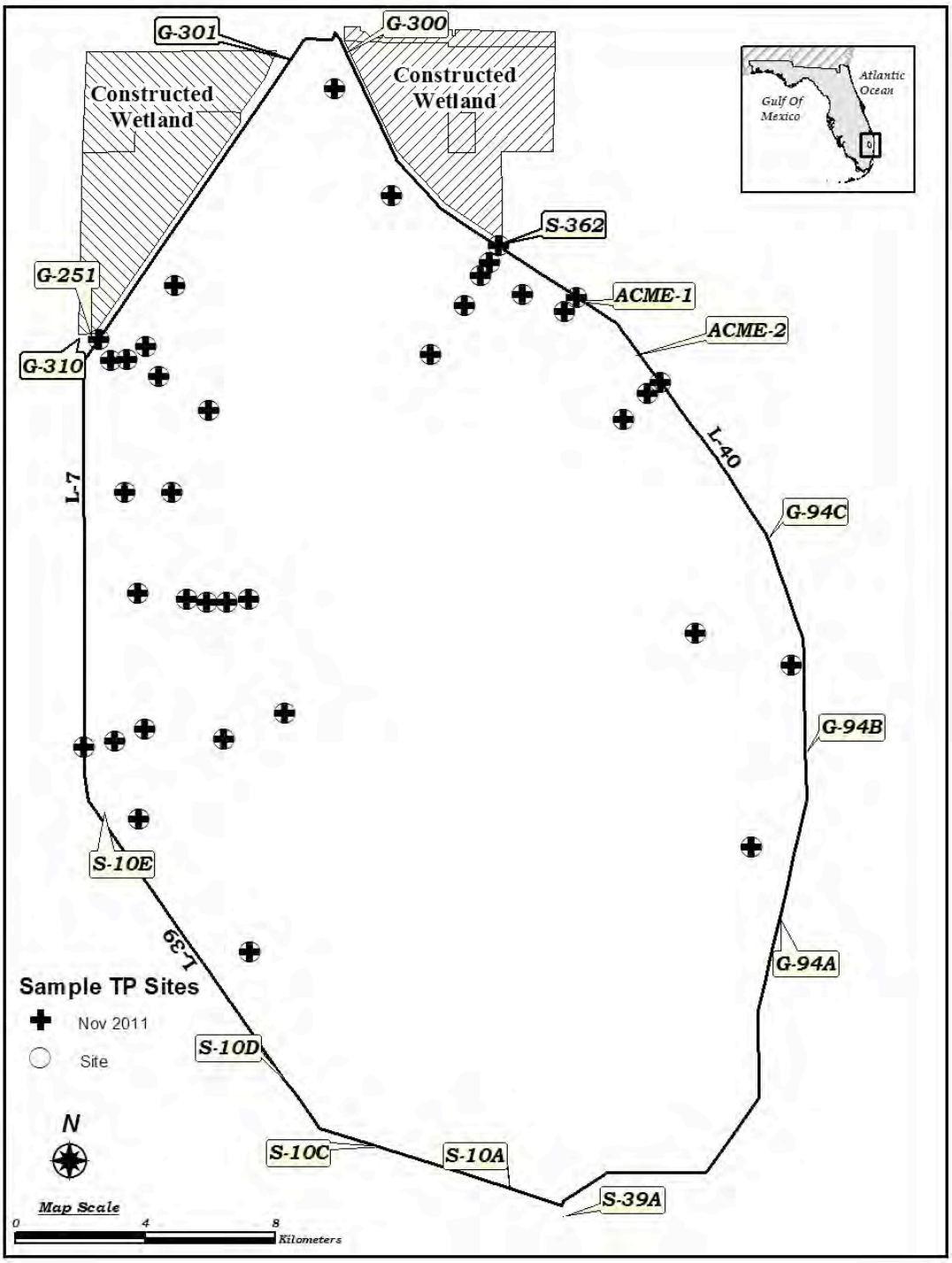

Figure 3. November 2011 map of total phosphorus sample collections from the Enhanced Water Quality Monitoring and the EVPA stations in the A.R.M. Loxahatchee National Wildlife Refuge. A primary reason that a station is not sampled is that it has less than 10 cm of clear water column representative of that area.

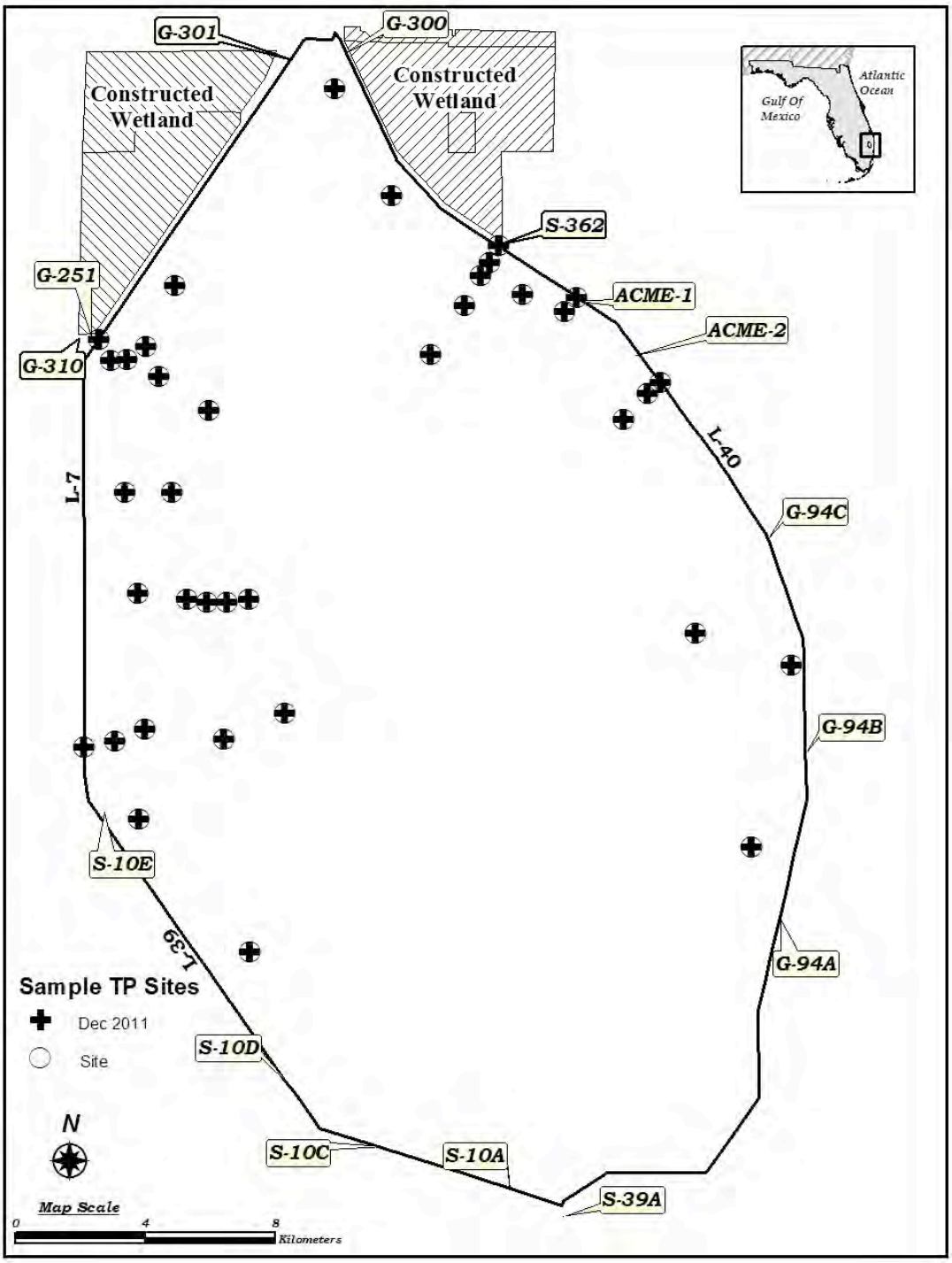

Figure 4. December 2011 map of total phosphorus sample collections from the Enhanced Water Quality Monitoring and the EVPA stations in the A.R.M. Loxahatchee National Wildlife Refuge. A primary reason that a station is not sampled is that it has less than 10 cm of clear water column representative of that area.